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EXAMINER	
ODOM, CURTIS B	
ART UNIT	**PAPER NUMBER**
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Please find below and/or attached an Office communication concerning this application or proceeding.

8

Office Action Summary	Application No.	Applicant(s)
	09/471,659	CLARK ET AL.
	Examiner	**Art Unit**
	Curtis B. Odom	2634

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 March 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *2-9,12-14,16,17,20-26 and 28-53* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *2-9,12-14,16,17,20-26 and 28-53* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *2/19/2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claim 49 is objected to because of the following informalities: It is suggested claim 49 depend upon claim 48. Appropriate correction is required.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 8, 13, 20, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardener et al (previously cited in Office Action 9/8/03) in view of Isaksson et al. (previously cited in Office Action 3/19/2004) and in further view of Lindemann et al. (U. S. Patent No. 6, 529, 710).

Regarding claim 8, Gardener et al. discloses a telemetry system for transmitting well-logging data from at least one downhole tool (Fig. 1, block 12) to a surface data acquisition system (Fig. 1, block 29), the at least one downhole tool having a first tool data input/output interface (Fig. 1, block 16), the telemetry system comprising:

a down hole telemetry cartridge (Fig. 1, block 17) connected to at least one down hole tool (Fig. 1, block 12) via a modem (TX and RX) interface connected to the first tool data input/output interface (Fig. 1, block 16), wherein the downhole telemetry receives a bitstream for the at least one downhole tool over the modem input/ouput (TX/RX) interface (column 3, lines 1-9) and comprising:

an UL transmitter (Fig. 1, block 17 and Fig. 2, column 3, lines 10-15) connected to the second tool data input/output interface having a logic operable to cause the transmission of signals to an uphole telemetry unit connected to the downhole telemetry cartridge by a wireline, and

a cable driver (Fig. 2, cable driver) having transmission power level control circuitry having logic to control the transmission power to optimize the total transmission power applied to the wireline cable;

an uphole telemetry unit (Fig. 1, block 28) connected to the surface data acquisition system (Fig. 1, block 29) via an surface modem interface (Fig. 1, block 28 TX/RX interface) and comprising:

a receiver (Fig. 1, block 28 and Fig. 3, column 3, lines 16-23) connected to the surface data acquisition system having logic operable to receive the analog signals, to detect and decode (demodulate) the received signals into a bit stream and to output the bit stream to the acquisition computer via the TX/RX interface; and

a wireline cable (Fig. 1, block 11, column 3, lines 24-32) providing an electrical connection between the downhole telemetry cartridge and the uphole telemetry unit, wherein the analog signals are transmitted in an uphole direction on the wireline cable.

Gardener et al. does not disclose the apparatus having logic operable to cause transmission of the bitstream as analog signals on a plurality of carrier frequencies and logic operable to receive the analog signals on the plurality of carrier frequencies and optimizing the the total transmission power applied to the wireline in response to a received adjustment signal transmitted from the uphole telemetry unit wherein the adjustment signal is a function of cable length, cable material, cable temperature, and cable geometry; wherein the uphole telemetry units includes logic includes logic to repeatedly measure the received signal amplitude and to transmit the received adjustment signal in response to the measurment to the downhole telemetry cartiridge.

However, Isaksson et al. discloses logic (Fig. 4, column 7, lines 5-19) operable to cause transmission (Fig. 4, Transmitter) of the bitstream as analog signals (multi-level pulses) on a plurality of carrier frequencies and logic (Fig. 4, Receiver) operable to receive the analog signals (multi-level pulses) on the plurality of carrier frequencies by the use of DMT modulation and logic to control. DMT modulation causes transmission of the bitstream as analog signals on a plurality of carrier frequencies. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the transmitter and receiver of Gardener et al. with the transmitter and receiver logic of Isaksson et al. since Isaksson et al. states DMT modulation handles frequency dependent loss and noise in cables in an efficient manner and also provides high bit rate traffic over the cables (column 1, lines 14-23 and column 7, lines 5-20).

Lindemann further discloses optimizing a transmission power applied to a wireline cable by measuring the power level of a signal transmitted through transmission cables received at an antenna and comparing this measured power to the power of the transmitted signal at the signal

source (column 10, lines 29-46). The comparison is then used to generate a power control signal as function of cable loss which is transmitted to a power amplifier used to adjust the signal power level of the transmitted signal before it is transmitted though the transmission cables (column 10, lines 41-47). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to modify system of Gardener et al. and Isaksson et al. with the transmission power control as taught by Lindemann since Lindemann et al. states the transmission power control compensates for power losses in the transmission cable (column 10, lines 45-47) caused by the length and type of cable (column 1, lines 57-61 and column 2, lines 41-44).

Regarding claim 13, the claim includes limitations corresponding to the above rejection of claim 8, which is applicable hereto.

Regarding claim 20, which inherits the limitations of claim 8, Gardener et al. further discloses the downhole telemetry cartridge is constructed from components capable of operation at temperatures above 150 degrees Celsius (column 3, lines 51-64).

Regarding claims 30, Gardener et al. further discloses using a wireline cable for transmission (column 3, lines 36-50), but Gardner et al, Isaksson et al. and Lindemann do not specifically disclose using a heptacable wireline cable. However, it would have been obvious to one skilled in the art at the time the invention that the use of a cable which provides resistance to temperature and pressure as taught by Gardener et al. (column 3, lines 35-60). Therefore, it would be obvious to use a certain type of cable to provide resistance against the effects of well-logging.

4. Claims 2-7, 9, and 42-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardener et al (previously cited in Office Action 9/8/03) in view of Cioffi et al. (U. S. Patent No. 6, 473, 438) and in further view of Baird et al. (previously cited in Office Action 9/8/03).

Regarding claim 2, which inherits the limitations of claim 9, Gardener et al. further discloses the downhole telemetry cartridge (transmitter/receiver) is integrated into one of the at least one downhole tool (Fig. 2, column 2, lines 29-30).

Regarding claim 3, which inherits the limitations of claim 9, Gardener et al. further discloses the uphole receiver contains a clock recovery circuit to recover the clocking signal from the downhole unit operating at 360 KHz (column 6, lines 16-23 and column 7, lines 21-25), representing the downhole telemetry cartridge operating at a clock (sampling) frequency of 360 kHz, which is between 300 kHz and 500 kHz.

Regarding claim 4, which inherits the limitations of claim 9, Gardener et al. further discloses a cable driver (Fig. 2, cable driver) to drive the transmission signal to a desired frequency band (column 3, lines 10-16) and amplify the signal to convenient power level in a fashion similar to the line driver (column 3, lines 16-19) wherein these operations adjust total output power of the analog signal to a power level optimized (convenient) for the wireline cable.

Regarding claim 5, which inherits the limitations of claim 4, Gardener et al., Baird et al. and Cioffi et al. do not disclose the cable driver operating from a voltage supply range of at least –15 to 15 volts. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to supply a range of at least –15 to 15 volts to the driver to drive the transmission signal to a desired frequency band (Gardener et al, column 3, lines 10-16) and

amplify the signal to convenient power level in a fashion similar to the line driver (Gardener, et al., column 3, lines 16-19).

Regarding claim 6, which inherits the limitations of claim 4, Gardener et al., Baird et al. and Cioffi et al. do not specifically disclose the cable driver driving the total output power to the maximum input tolerance power level of the receiver. However, Baird et al. does discloses controlling power sources such as drivers to maximize the power capacity of a well-logging cable (column 11, lines 47-53). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to include this feature because maximizing power capacity of the cable and receiver would allow one the maximize data throughput.

Regarding claim 7, which inherits the limitations of claim 6, Gardener et al. further discloses the cable driver (Fig. 2, cable driver) operates to drive the total output power without consideration for cross-talk with other signals, wherein there is no mention that the cable driver of Gardener et al. taking into account cross-talk while driving the signal.

Regarding claim 9, Gardener et al. discloses a telemetry system for transmitting well-logging data from at least one downhole tool (Fig. 1, block 12) to a surface data acquisition system (Fig. 1, block 29), the at least one downhole tool having a first tool data input/output interface (Fig. 1, block 16), the telemetry system comprising:

a down hole telemetry cartridge (Fig. 1, blocks 17) connected to an uphole telemetry unit (Fig. 1, blocks 28-31) over a wireline cable (Fig. 1, element 11) that provides an electrical connection between the downhole telemetry cartridge and the uphole telemetry unit;

an down hole telemetry cartridge (Fig. 1, block 17 and Fig. 2, column 3, lines 10-15) connected to the at least one dowhole tool (Fig. 1, block 12) via a modem TX/RX interface

connected to the first tool data input/output interface (Fig. 1, block 16), wherein the downhole telemetry cartridge receives a bitstream from the at least one downhole tool over the modem input/ouput (TX/RX) interface (column 3, lines 1-9) and comprising:

an uplink (UL) transmitter (Fig. 1, block 17 and Fig. 2, column 3, lines 10-15) connected to the second tool data input/output interface having a logic operable to cause the transmission of signals to an uphole telemetry unit; and

an uphole telemetry unit (Fig. 1, block 28) connected to the surface data acquisition system (Fig. 1, block 29) via an surface modem interface (Fig. 1, block 28 TX/RX interface) and comprising:

a receiver (Fig. 1, block 28 and Fig. 3, column 3, lines 16-23) connected to the surface data acquisition system having logic operable to receive the analog signals, to detect and decode (demodulate) the received signals into a bit stream and to output the bit stream to the acquisition computer via the TX/RX interface; and

an uphole transmitter (Fig. 1, Surface Modem Transmitter (TX), column 3, lines 1-9) to transmit control signals from the surface computer (acquisition) system to the at least one down hole tool.

Gardener et al. does not disclose performing a training sequence periodically in the downhole transmitter having logic operable to cause transmission of the bitstream as analog signals on a plurality of carrier frequencies, including transmitting a known signal on the plurality of carriers, to receive a control signal, and in response to a control signal, to adjust at least one characteristic selected from the set of total power, power-per-carrier and bits-per carrier, wherein the receiver in the uphole unit contains logic operable to receive the analog

signals on the plurality of carrier frequencies and the training sequence and adjust one of the set of characteristics based on the control signal. Gardener also does not disclose the control signals including a pilot signal are transmitted simultaneously on the wireline cable in a second propagation mode that is different from the first propagation mode.

However, Cioffi et al. discloses a remote unit (Fig. 1, block 22) having logic operable to cause transmission of the bitstream as analog signals on a plurality of carrier frequencies (column 7, lines 57-61) using DMT modulation, including transmitting a training signal (column 16, lines 51-62) on the plurality of carriers (sub-channels), to receive a control signal to adjust a a bits-per channel (see column 23, lines 11-18) wherein a receiver in a central unit (Fig. 1, block 10, column 7, lines 21-29) contains logic operable to receive the analog signals on the plurality of carrier frequencies and the training sequence (column 16, lines 51-62) and adjust a bits-per-carrier based on the training signal (column 16, line 62-column 17, line 10). Cioffi et al. further discloses the units are retrained periodically (column 17, lines 12-29 and column 25, lines 38-63) Cioffi et al. further discloses transmitting a pilot signal to obtain synchronization between the remote and central units (column 12, lines 1-7). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to modify the system of Gardener et al. with DMT modulation and training as taught by Cioffi et al. since Cioffi et al. states DMT modulation avoids various signal distortion and noise problems (column 1, lines 21-25). It would have also been obvious to include the feature of the pilot signal to allow synchronization between a transmitter and receiver.

Baird et al. further discloses transmitting control signals such as pilot signals in a wireline well-logging telemetry system simultaneously on a wireline cable using different power

transmission modes (eigenmodes) representing different propagation modes (column 5, line 45-column 6, line 16). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the device of Gardener et al. and Cioffi et al. with the teachings of Baird et al. and use different propagation modes over the cable in order to compensate for distortions over the cable (see Cioffi et al., column 5, lines 1-12).

Regarding claim 42, Cioffi et al. further discloses training the carriers is performed periodically (column 17, lines 11-32). It would have been obvious to include this feature to allow the dynamic adjustment of communication parameters based on line quality parameters which vary over time (Cioffi et al. column 25, lines 57-63).

Regarding claim 43, Cioffi et al. further discloses retransmitting the training signal (retraining) in response to the line quality characteristics (column 25, lines 43-62).). It would have been obvious to include this feature to allow the dynamic adjustment of communication parameters based on line quality parameters which vary over time (Cioffi et al. column 25, lines 57-63).

Regarding claim 44, Cioffi et al. further discloses retransmitting the training signal (retraining) in response to the line quality characteristics such as signal-to-noise ratio (column 25, lines 43-62). It would have been obvious to include this feature to allow the dynamic adjustment of communication parameters based on line quality parameters which vary over time (Cioffi et al. column 25, lines 57-63).

5. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gardener et al (previously cited in Office Action 9/8/03) in view of Cioffi et al. (U. S. Patent No. 6, 473, 438) and in further view of Isaksson et al. (previously cited in Office Action 3/19/2004).

Regarding claim 12, Gardener et al. discloses a telemetry system for transmitting well-logging data from at least one downhole tool (Fig. 1, block 12) to a surface data acquisition system (Fig. 1, block 29), the at least one downhole tool having a first tool data input/output interface (Fig. 1, block 16), the telemetry system comprising:

a down hole telemetry cartridge (Fig. 1, block 17 and Fig. 2, column 3, lines 10-15) connected to the at least one dowhole tool (Fig. 1, block 12) via a modem TX/RX interface connected to the first tool data input/output interface (Fig. 1, block 16), wherein the downhole telemetry cartridge receives a bitstream from the at least one downhole tool over the modem input/ouput (TX/RX) interface (column 3, lines 1-9) and comprising:

an uplink (UL) transmitter (Fig. 1, block 17 and Fig. 2, column 3, lines 10-15) connected to the second tool data input/output interface having a logic operable to cause the transmission of signals to an uphole telemetry unit; and

a cable driver (see Gardener et al. ,Fig. 2, cable driver) to drive the transmission signal to a desired frequency band (column 3, lines 10-16) and amplify the signal to convenient power level (column 3, lines 16-19) and

an uphole telemetry unit (Fig. 1, block 28) connected to the surface data acquisition system (Fig. 1, block 29) via an surface modem interface (Fig. 1, block 28 TX/RX interface) and comprising:

a receiver (Fig. 1, block 28 and Fig. 3, column 3, lines 16-23) connected to the surface data acquisition system having logic operable to receive the analog signals, to detect and decode (demodulate) the received signals into a bit stream and to output the bit stream to the acquisition computer via the TX/RX interface; and

a wireline cable (Fig. 1, block 11, column 3, lines 24-32) providing an electrical connection between the downhole telemetry cartridge and the uphole telemetry unit, wherein analog signals are transmitted in an uphole direction on the wireline cable.

Gardener et al. does not disclose performing a training sequence periodically in the downhole transmitter having logic operable to cause transmission of the bitstream as analog signals on a plurality of carrier frequencies, including transmitting a known signal on the plurality of carriers, to receive a control signal, and in response to a control signal, to adjust the power-per-carrier wherein the receiver in the uphole unit contains logic operable to receive the analog signals on the plurality of carrier frequencies and the training sequence and determine an adjustment to the power-per-carrier. Gardener also does not disclose the cable driver independently controls the transmission power of each carrier frequency using control signals from the uphole unit. However, Cioffi et al. discloses a remote unit (Fig. 1, block 22) having logic operable to cause transmission of the bitstream as analog signals on a plurality of carrier frequencies (column 7, lines 57-61) using DMT modulation, including transmitting a training signal (column 16, lines 51-62) on the plurality of carriers (sub-channels), to receive a control signal to adjust a a bits-per channel (see column 23, lines 11-18) wherein a receiver in a central unit (Fig. 1, block 10, column 7, lines 21-29) contains logic operable to receive the analog signals on the plurality of carrier frequencies and the training sequence (column 16, lines 51-62) and adjust a bits-per-carrier based on the training signal (column 16, line 62-column 17, line 10). Cioffi et al. further discloses the units are retrained periodically (column 17, lines 12-29 and column 25, lines 38-63) Therefore, it would have been obvious to one skilled in the art at the time the invention was made to modify the system of Gardener et al. with DMT modulation and

training as taught by Cioffi et al. since Cioffi et al. states DMT modulation avoids various signal distortion and noise problems (column 1, lines 21-25).

Isaksson et al. further discloses using a training period similar to Cioffi et al. which is used to measure an SNR to determine a transmission power (power-per-carrier) for each individual carrier frequency (column 7, lines 5-20 and column 19, lines 36-47). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to modify the system of Gardener et al. and Cioffi et al. to incorporate adjusting the transmission power (power-per-carrier) of each carrier frequency during training as taught by Isaksson et al. in order to adjust the power of each carrier using a control signal based on a training signal (as disclosed by Cioffi et al. above) since Isaksson et al. states this approach handles frequency dependent loss and noise in the cables (column 7, lines 5-20).

6. Claims 14, 16, 17, 21-25, 28, 29, 31-35, 37-41, 48 and 51-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardener et al (previously cited in Office Action 9/8/03) in view of Matsumoto (previously cited in Office Action 1/26/2005) and in further view of Cioffi et al. (U. S. Patent No. 6, 473, 438).

Regarding claim 14, Gardener et al. discloses a telemetry system for transmitting well-logging data from at least one downhole tool (Fig. 1, block 12) to a surface data acquisition system (Fig. 1, block 29), the at least one downhole tool having a first tool data input/output interface (Fig. 1, block 16), the telemetry system comprising:

a downhole telemetry cartridge (Fig. 1, block 17 and Fig. 2, column 3, lines 10-15) connected to the at least one dowhole tool (Fig. 1, block 12) via a modem TX/RX interface connected to the first tool data input/output interface (Fig. 1, block 16), wherein the downhole

telemetry cartridge receives a bitstream from the at least one downhole tool over the modem input/ouput (TX/RX) interface (column 3, lines 1-9) and comprising:

an uplink (UL) transmitter (Fig. 1, block 17 and Fig. 2, column 3, lines 10-15) connected to the second tool data input/output interface having a logic operable to cause the transmission of signals to an uphole telemetry unit; and

an uphole telemetry unit (Fig. 1, block 28) connected to the surface data acquisition system (Fig. 1, block 29) via an surface modem interface (Fig. 1, block 28 TX/RX interface) and comprising:

a receiver (Fig. 1, block 28 and Fig. 3, column 3, lines 16-23) connected to the surface data acquisition system having logic operable to receive the analog signals, to detect and decode (demodulate) the received signals into a bit stream and to output the bit stream to the acquisition computer via the TX/RX interface; and

a wireline cable (Fig. 1, block 11, column 3, lines 24-32) providing an electrical connection between the downhole telemetry cartridge and the uphole telemetry unit, wherein analog signals are transmitted in an uphole direction on the wireline cable.

Gardener et al. does not disclose the apparatus having logic operable to cause transmission of the bitstream as analog signals on a plurality of carrier frequencies and logic operable to receive the analog signals on the plurality of carrier frequencies wherein the logic includes:

a tone ordering logic operable to divide the bit stream into bit groups such that there is a one-to-one mapping between bit groups and carrier frequencies;

a bits-per-carrier table containing a mapping between each bit group and the number of bits allocated to each carrier for one cycle of operation; and

a constellation encoder connected to receive the bit groups from the tone ordering logic and the bits-per-carrier from the bits-per-carrier table, and operable to encode the bit groups as complex numbers.

Gardener et al. further does not disclose a training logic executed repeatedly during the course of a logging job and operable to produce the bits-per-carrier table.

Matsumoto discloses an apparatus (Fig. 2 and Fig. 4) which can be enclosed in a transmitter/receiver (modem) having logic operable to cause transmission of the bitstream as analog signals on a plurality of carrier frequencies and logic operable to receive the analog signals on the plurality of carrier frequencies by use of DMT modulation (column 1, lines 15-25), wherein the logic includes:

a tone ordering logic (Fig. 4, block 88, column 10, lines 14-42) operable to divide the bit stream into bit groups by assigning the signal (bits) to each carrier for each frequency band such that there is a one-to-one mapping between bit groups and carrier frequencies;

a bits-per-carrier table (Figs. 2 and 4, blocks 79 and 80, column 1, lines 38-47, column 5, lines 49-57 and column 12, lines 16-32) containing a mapping between each bit group and the number of bits allocated to each carrier for one cycle of operation; and

a constellation encoder (Fig. 4, block 89, column 7, lines 31-52 and column 12, lines 16-32) connected to receive the bit groups from the tone ordering logic and the bits-per-carrier from the bits-per-carrier table, and operable to encode the bit groups as a constellation (complex numbers).

DMT modulation causes transmission of the bitstream as analog signals on a plurality of carrier frequencies. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the transmitter and receiver of Gardener et al. with the transmitter and receiver logic of Matsumoto since Matsumoto states DMT modulation can provide high speed digital communication (column 1, lines 15-25).

Cioffi et al. further discloses executing a training logic (retraining) repeatedly during the course of a communication session which is operable to update a bits-per-carrier matrix (column 17, lines 11-45). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to modify the system of Gardener et al. and Matsumoto with the periodic training signal as taught by Cioffi et al. to allow the dynamic adjustment of communication parameters based on line quality parameters (Cioffi et al. column 25, lines 57-63).

Regarding claim 16, Cioffi et al. further discloses the training logic comprises a first logic in a first device (Fig. 1, block 22) and a second logic in a second device (Fig. 1, block 10), wherein the first logic comprises:

logic (column 16, lines 51-54) operable to transmit a training signal on each of a plurality of carriers; and

logic (column 23, lines 11-19) operable to receive the number of bits-per-carrier from the second device;

the second logic comprising:

logic (column 25, lines 41-47) operable to measure the signal-to-noise ratio of the training signal;

logic (column 25, lines 48-56) operable to determine the number of bits-per-carrier (amount of data to be transmitted on each channel) as a function of the signal-to-noise ratio (wherein the SNR is a line quality parameter); and

logic (column 23, lines 11-19) operable to cause transmission of the number of bits-per-carrier to the first device.

It would have been obvious to include the training logic to allow the dynamic adjustment of communication parameters based on line quality parameters (Cioffi et al. column 25, lines 57-63).

Regarding claim 17, Cioffi et al. further discloses the first device (Fig. 1, block 22) comprises logic to populate a bits-per-carrier table (column 23, lines 11-19) based on instructions from the second device (Fig. 1, block 10); and

the second device determines a bits-per-carrier table (column 17, lines 2-10) with the same number of bits-per-carrier sent by instructions to the first device (column 23, lines 11-19). It would have been obvious to include the training logic to allow the dynamic adjustment of communication parameters based on line quality parameters (Cioffi et al. column 25, lines 57-63).

Regarding claim 21, Gardener et al. discloses a method of operating a well-logging telemetry system having a downhole telemetry cartridge (Fig. 1, blocks 12 and 14-17) and an uphole telemetry unit (Fig. 1, blocks 28-31) connected by a wireline cable (Fig. 1, block 11). Gardener does not disclose executing a training sequence having the steps of:

transmitting a known signal on each of a plurality of carriers from the downhole telemetry cartridge to the uphole telemetry unit;

measuring at the second telemetry unit the signal-to-noise ratio on the known signal on each of the plurality of carriers;

using the signal-to-noise ratio measurement to determine the number of bits-per constellation to use for each carrier; and

populating a bits-per-carrier table with the bits-per-constellation value for each carrier; and

dynamically adjusting the bit-per-carrier table during the course of a logging job by re-transmitting the known signal on a subset of the plurality of carriers, re-measuring at the uphole telemetry unit the signal-to-noise ratio on each of the subset of the plurality of carriers, using the re-measured signal-to-noise ratio on each of the subset of the plurality of carrier to determine the number of bits-per-constellation to use for each subset of the plurality of carriers; and populating the bits-per-carrier table entries for each subset of the plurality of carriers with the bits-per-constellation value for each of the subset of the plurality of carriers.

However, Matsumoto discloses a method of operating a system having a first telemetry cartridge (Fig. 1A) and a second telemetry cartridge (Fig. 1B) connected by a wireline cable (telephone line) comprising executing a training logic having the steps of:

transmitting (column 1, lines 38-47) a known signal (received wave for each channel) on each of a plurality of carriers from the first telemetry cartridge to the second telemetry unit;

measuring (column 1, lines 38-47) at the second telemetry unit the signal-to-noise ratio on the known signal on each of the plurality of carriers;

using (column 1, lines 38-47) the signal-to-noise ratio measurement to determine the number of bits-per constellation to use for each carrier; and

populating (column 1, lines 38-47 and column 5, lines 49-57) a bits-per-carrier table with the bits-per-constellation value for each carrier.

This training is performed for DMT modulation (column 1, lines 38-39). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Gardener et al. with the DMT modulation and training method of Matsumoto since Matsumoto states DMT modulation can provide high speed digital communication (column 1, lines 15-25).

Cioffi et al. further discloses dynamically updating (column 17, lines 26-45) the bit-per-carrier table for DMT modulation during the course of a communication session by re-transmitting a training signal (re-training) on a subset of the plurality of carriers, re-measuring the signal-to-noise ratio of the training signal (column 25, lines 41-47), using the re-measured signal-to-noise ratio to determine the amount of data (column 25, lines 46-52) transmitted on each channel (bits-per-carrier) to use for each subset of the plurality of carriers (column 17, lines 39-45); and populating a bits-per-carrier matrix entries for each subset of the plurality of carriers with the bits-per-carrier (column 17, lines 39-52) value for each of the subset of the plurality of carriers. Therefore, it would have been obvious to one skilled in the art at the time the invention was made to modify the method of Gardener et al. and Matsumoto with the retraining as taught by Cioffi et al. to allow the dynamic adjustment of communication parameters based on line quality parameters which vary over time (Cioffi et al. column 25, lines 57-63).

Regarding claim 22, which inherits the limitations of claim 21, Matsumoto further disclose populating a bits-per-carrier table the first and second telemetry cartridges (column 5, lines 21-32 and lines 49-57). It would have been obvious to include this feature since

Matsumoto states DMT modulation can provide high speed digital communication (column 1, lines 15-25).

Regarding claim 23, Gardener et al. disclose acquiring well-logging data from a well-logging tool (column 2, line 66-column 3, line 9). However, Gardener et al., Matsumoto, and Cioffi et al. do not disclose one of the steps of the training sequence is executed concurrently with the step of acquiring well-log data. However, it would have been obvious to one skilled in the art to include this feature since Cioffi et al. discloses training allows dynamic adjustment of communication parameters based on line quality parameters which vary over time (Cioffi et al. column 25, lines 57-63).

Regarding claims 24 and 25, Matsumoto discloses both frequency and time domain equalization (column 5, lines 32-47), but Gardener et al., Matsumoto and Cioffi et al. do not specifically disclose transmitting a known complex number from the dowhole unit to the second uphole unit; receiving a transmitted complex number at the uphole unit; and dividing the receive complex number by the known complex number to obtain an adjustment parameter for equalization.

However, Gardener et al. does disclose an adaptive equalization method (Fig. 9, column 5, lines 20-34) which includes transmitting a known signal y(T), receiving and estimating the known signal, comparing the receive and processed signal d(T-L) with the equalized transmitted known signal d(T-L) to obtain an estimation error (column 7, lines 41-47), and using the estimation error for equalization (column 7, lines 49-67). Therefore, it would have been obvious to include this feature or similar method for adjusting equalization parameters since Gardener et

al. states adaptive equalization can continuously correct for cable distortion (column 8, lines 31-34).

Regarding claim 28, Gardener et al. discloses a method of operating a well-logging telemetry system having a downhole telemetry cartridge (Fig. 1, blocks 12 and 14-17) and an uphole telemetry unit (Fig. 1, blocks 28-31) connected by a wireline cable (Fig. 1, block 11). Gardener does not disclose the method includes the steps of:

modulating a bit stream onto a plurality of carrier frequencies;

transmitting the modulated bit stream on a first propagation mode from the downhole device to the uphole device;

operating the uphole device to demodulate the received bitstream;

during the course of a logging job, repeatedly;

using a training sequence to populate a bits-per-carrier table in the dowhole device and a bits-per-carrier table in the uphole device;

wherein the step of modulating the bit stream onto a plurality of carrier frequencies modulates the bit stream for each carrier according to values stored in the downhole bits-per-carrier table for such each carrier; and

wherein the step of demodulating the bit stream demodulates the bit stream from each carrier according to values stored in the uphole bits-per-carrier table

However, Matsumoto discloses a method of operating a system having a device (Fig. 3, 6a) and a second device (Fig. 3, 6b) connected by a wireline cable (telephone line) comprising:

modulating (Fig. 4, column 9, line 26-column 10, line 23) a bit stream onto a plurality of carrier frequencies;

transmitting (Fig. 4, column 9, line 26-column 10, line 23) the modulated bit stream on a first propagation mode from the first device to the second device;

operating (Fig. 4, column 6, line 43-column 7, line 63) the second device to demodulate the received bitstream;

using (column 1, lines 38-47, column 5, lines 49-56, and column 12, lines 17-32) a training sequence to populate a bits-per-carrier table in the first device and a bits-per-carrier table in the second device;

wherein (column 1, lines 38-47, column 5, lines 49-56, and column 14, lines 17-32) the step of modulating the bit stream onto a plurality of carrier frequencies modulates the bit stream for each carrier according to values stored in the first device for such each carrier; and

wherein the step of demodulating the bit stream demodulates the bit stream from each carrier according to values stored in the second device (column 1, lines 38-47, column 5, lines 49-56, and column 14, lines 17-32).

The modulation and training is performed using DMT modulation (column 1, lines 38-39). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Gardener et al. with the DMT modulation and training method of Matsumoto since Matsumoto states DMT modulation can provide high speed digital communication (column 1, lines 15-25).

Cioffi et al. further discloses executing a training sequence (retraining) repeatedly during the course of a communication session which is operable adjust characteristics of a carrier matrix (column 17, lines 11-45). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to modify the method of Gardener et al. and Matsumoto with the

repetition of training signal as taught by Cioffi et al. to allow the dynamic adjustment of communication parameters based on line quality parameters which vary over time (Cioffi et al. column 25, lines 57-63).

Regarding claim 29, Gardener et al. discloses a method of operating a well-logging telemetry system having a downhole telemetry cartridge (Fig. 1, blocks 12 and 14-17) and an uphole telemetry unit (Fig. 1, blocks 28-31) connected by a wireline cable (Fig. 1, block 11). Gardener does not disclose the method includes the steps of:

modulating a bit stream onto a plurality of carrier frequencies;

transmitting the modulated bit stream on a first propagation mode from the downhole device to the uphole device;

operating the uphole device to demodulate the received bitstream;

during the course of a logging job, repeatedly;

using a training sequence to populate a gain table in the first device and a gain table in the uphole device; and

adjusting the gain on each carrier based on values stored in the gain table of the downhole device.

However, Matsumoto discloses a method of operating a system having a device (Fig. 3, 6a) and a second device (Fig. 3, 6b) connected by a wireline cable (telephone line) comprising:

modulating (Fig. 4, column 9, line 26-column 10, line 23) a bit stream onto a plurality of carrier frequencies;

transmitting (Fig. 4, column 9, line 26-column 10, line 23) the modulated bit stream on a first propagation mode from the first device to the second device;

operating (Fig. 4, column 6, line 43-column 7, line 63) the second device to demodulate the received bitstream;

using (column 1, lines 38-47, column 5, lines 49-56, and column 12, lines 17-32) a training sequence to populate a gain table in the first device and a gain table in the second device; and

adjusting the gain on each carrier based on values stored in the gain table of a first device (column 1, lines 38-47, column 5, lines 49-56, and column 12, lines 17-32).

The modulation and training is performed using DMT modulation (column 1, lines 38-39). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Gardener et al. with the DMT modulation and training method of Matsumoto since Matsumoto states DMT modulation can provide high speed digital communication (column 1, lines 15-25).

Cioffi et al. further discloses executing a training sequence (retraining) repeatedly during the course of a communication session which is operable adjust characteristics of the carriers (column 17, lines 11-45). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to modify the method of Gardener et al. and Matsumoto with the repetition of training signal as taught by Cioffi et al. to allow the dynamic adjustment of communication parameters based on line quality parameters which vary over time (Cioffi et al. column 25, lines 57-63).

Regarding claims 31 and 32, Gardener et al. further discloses using a wireline cable for transmission (column 3, lines 36-50), but Gardner et al, Matsumoto, and Cioffi et al. do not specifically disclose using a heptacable wireline cable. However, it would have been obvious to

one skilled in the art at the time the invention that the use of a cable which provides resistance to temperature and pressure as taught by Gardener et al. (column 3, lines 35-60). Therefore, it would be obvious to use a certain type of cable to provide resistance against the effects of well-logging.

Regarding claim 33, Gardener et al. further discloses the downhole telemetry cartridge (transmitter/receiver) is integrated into one of the at least one downhole tool (Fig. 2, column 2, lines 29-30).

Regarding claims 34, Gardener et al. further discloses using a wireline cable for transmission (column 3, lines 36-50), but Gardner et al, Matsumoto, and Cioffi et al. do not specifically disclose using a heptacable wireline cable. However, it would have been obvious to one skilled in the art at the time the invention that the use of a cable which provides resistance to temperature and pressure as taught by Gardener et al. (column 3, lines 35-60). Therefore, it would be obvious to use a certain type of cable to provide resistance against the effects of well-logging.

Regarding claim 35, Gardener et al. further discloses the downhole telemetry cartridge is constructed from components capable of operation at temperatures above 150 degrees Celsius (column 3, lines 51-64).

Regarding claim 37, Cioffi et al. futher discloses retraining the carriers is performed periodically (column 17, lines 11-32). It would have been obvious to include this feature to allow the dynamic adjustment of communication parameters based on line quality parameters which vary over time (Cioffi et al. column 25, lines 57-63).

Regarding claim 38, Cioff et al. further discloses retransmitting the training signal (retraining) in response to the line quality characteristics (column 25, lines 43-62).). It would have been obvious to include this feature to allow the dynamic adjustment of communication parameters based on line quality parameters which vary over time (Cioffi et al. column 25, lines 57-63).

Regarding claim 39, Cioffi et al. further discloses retransmitting the training signal (retraining) in response to the line quality characteristics such as signal-to-noise ratio (column 25, lines 43-62). It would have been obvious to include this feature to allow the dynamic adjustment of communication parameters based on line quality parameters which vary over time (Cioffi et al. column 25, lines 57-63).

Regarding claim 40, Cioffi et al. discloses transmitting the retraining signal to detect line quality parameters in response to the changes in line quality during use (column 25, lines 46-63).

Regarding claim 41, Cioffi et al. discloses transmitting the retraining signal to detect line quality parameters in response to the changes in line quality such as signal-to-noise ratio during use (column 25, lines 46-63).

Regarding claim 48, Cioffi et al. futher discloses retraining to populate a bits-per-carrier matrix is performed periodically (column 17, lines 11-32). It would have been obvious to include this feature to allow the dynamic adjustment of communication parameters based on line quality parameters which vary over time (Cioffi et al. column 25, lines 57-63).

Regarding claim 51, Cioffi et al. futher discloses retraining to populate a bits-per-carrier matrix is performed periodically (column 17, lines 11-32). It would have been obvious to

include this feature to allow the dynamic adjustment of communication parameters based on line quality parameters which vary over time (Cioffi et al. column 25, lines 57-63).

Regarding claim 52, Cioffi et al. futher discloses retraining to populate a bits-per-carrier matrix is performed periodically (column 17, lines 11-32) in response to line quality characteristics (column 25, lines 43-62). It would have been obvious to include this feature to allow the dynamic adjustment of communication parameters based on line quality parameters which vary over time (Cioffi et al. column 25, lines 57-63).

Regarding claim 53, Cioffi et al. further discloses retraining to populate a bits-per-carrier matrix is performed periodically (column 17, lines 11-32) in response to line quality characteristics including signal-to-noise ratio (column 25, lines 43-62). It would have been obvious to include this feature to allow the dynamic adjustment of communication parameters based on line quality parameters which vary over time (Cioffi et al. column 25, lines 57-63).

7. Claims 26, 45-47, 49, and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardener et al (previously cited in Office Action 9/8/03) in view of Bae (previously cited in Office Action 1/26/2005) and in further view of Cioffi et al. (U. S. Patent No. 6, 473, 438).

Regarding claim 26, Gardener et al. discloses a method of operating a well-logging telemetry system having a downhole telemetry cartridge (Fig. 1, blocks 12 and 14-17) and an uphole telemetry unit (Fig. 1, blocks 28-31) connected by a wireline cable (Fig. 1, block 11). Gardener does not disclose repeatedly executing a training sequence having the steps of:

transmitting a signal of known power level on each of a plurality of carriers from the dowhole device to the uphole device;

measuring the signal amplitude received on each carrier;

comparing the power level received on each carrier to a predetermined maximum power level for each carrier

based on the comparison of the power level, transmitting an indication to adjust the power level on at least one of the carriers from the uphole device to the downhol device; and

adjusting the power level of at least one of the carriers based on the indication received.

However, Bae et al. discloses a method of operating a system having a device (Fig. 1 and Fig. 8) and a second device (Fig. 2 and Fig. 8) connected by a wireline cable which performs a training sequence including the steps of:

transmitting (column 4, lines 26-35) a signal of known power level on each of a plurality of carriers from the first device to the second device;

measuring (Fig. 5, step 400, column 4, line 36-column 5, line 25) the signal amplitude received on each carrier;

comparing (Fig. 5, steps 404, 406, and 408, column 4, line 36-column 5, line 25) the power level received on each carrier to a predetermined maximum power level for each carrier

based (Fig. 5, step 410, column 4, line 36-column 5, line 25) on the comparison of the power level, transmitting an indication to adjust the power level on at least one of the carriers from the second device to the first device; and

adjusting (Fig. 5, step 410, column 4, line 36-column 5, line 25) the power level of at least one of the carriers based on the indication received.

The training sequence is performed for multicarrier modulation (column 1, lines 5-14). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the well-logging method with the multicarrier modulation and training as

taught by Bae et al. since Bae states multicarrier modulation is the optimum modulation method in which data approximating channel capacity can be transmitted with a minimal error probability (column 1, lines 15-20).

Cioffi et al. further discloses executing a training sequence (retraining) repeatedly during the course of a communication session which is operable adjust characteristics of a carrier(column 17, lines 11-45). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to modify the system of Gardener et al. and Bae et al. with the repetition of training signal as taught by Cioffi et al. to allow the dynamic adjustment of communication parameters based on line quality parameters which vary over time (Cioffi et al. column 25, lines 57-63).

Regarding claim 45, Cioffi et al. further discloses retraining is performed periodically (column 17, lines 11-32). It would have been obvious to include this feature to allow the dynamic adjustment of communication parameters based on line quality parameters which vary over time (Cioffi et al. column 25, lines 57-63).

Regarding claim 46, Cioff et al. further discloses retransmitting the training signal (retraining) in response to the line quality characteristics (column 25, lines 43-62). It would have been obvious to include this feature to allow the dynamic adjustment of communication parameters based on line quality parameters which vary over time (Cioffi et al. column 25, lines 57-63).

Regarding claim 47, Cioffi et al. further discloses retransmitting the training signal (retraining) in response to the line quality characteristics such as signal-to-noise ratio (column 25, lines 43-62). It would have been obvious to include this feature to allow the dynamic

adjustment of communication parameters based on line quality parameters which vary over time (Cioffi et al. column 25, lines 57-63).

Regarding claim 49, Cioffi et al. further discloses retraining to populate a bits-per-carrier matrix is performed periodically (column 17, lines 11-32) in response to line quality characteristics (column 25, lines 43-62). It would have been obvious to include this feature to allow the dynamic adjustment of communication parameters based on line quality parameters which vary over time (Cioffi et al. column 25, lines 57-63).

Regarding claim 50, Cioffi et al. further discloses retraining to populate a bits-per-carrier matrix is performed periodically (column 17, lines 11-32) in response to line quality characteristics including signal-to-noise ratio (column 25, lines 43-62). It would have been obvious to include this feature to allow the dynamic adjustment of communication parameters based on line quality parameters which vary over time (Cioffi et al. column 25, lines 57-63).

8. Claim 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gardener et al (previously cited in Office Action 9/8/03) in view of Bae et al.(previously cited in Office Action 1/26/2005) and in further view of Cioffi et al. (U. S. Patent No. 6, 473, 438) as applied to claim 26, and further in view of Van Kerchove (previously cited in Office Action 9/12/2005).

Regarding claim 36, Gardener et al., Bae et al., and Cioffi et al. disclose all the limitations of claim 36 (see rejection above) except determining whether an increase in power level would improve the bits-per-carrier for the each carrier and whether a decrease in power level would degrade the bits-per-carrier for the each carrier; and

wherein in the transmitting step, based on both the comparison of power level and determination of improvement or degradation in bits-per-carrier for at least one of the carriers,

the indication to adjust the power level on the at least one of the carriers indicates to increase the power level if an improvement in number of bits-per-carrier may be achieved by a permissible increase in power and wherein the indication to adjust the power level on the at least one of the carriers indicates to lower the power level if there would be no degradation in the number of bits-per-carrier by lowering the power level.

Van Kerchove discloses determining whether an increase in power level would improve the bits-per-carrier for the each carrier (column 11, line 20-column 12, line 23) and whether a decrease in power level would degrade the bits-per-carrier for the each carrier (column 12, line 36-column 13, line 39, wherein the decision is based on a calculated noise margin); and

wherein in the transmitting step, based on both the comparison of power level and determination of improvement or degradation in bits-per-carrier for at least one of the carriers, the indication to adjust the power level on the at least one of the carriers indicates to increase the power level if an improvement in number of bits-per-carrier may be achieved by a permissible increase in power (column 4, lines 26-42 and column 11, line 20-column 12, line 23, wherein the improvement is increased data elements) and wherein the indication to adjust the power level on the at least one of the carriers indicates to lower the power level if there would be no degradation in the number of bits-per-carrier by lowering the power level (column 5, lines 14-25 and column 12, line 36-column 13, line 39, wherein the degradation is decreased noise margin).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the multicarrier transmission method of Gardener et al., Bae et al., and Cioffi et al. with the teachings of Van Kerchove since Van Kerchove states that his method allows the global capacity of the carriers to be enlarged and maximizes the minimum additional

noise margins amongst the carriers which renders data transmission less sensitive for noise (column 5, lines 4-25).

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Curtis B. Odom whose telephone number is 571-272-3046. The examiner can normally be reached on Monday- Friday, 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jay Patel can be reached on 571-272-2988. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Curtis Odom
May 11, 2006

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Primary Examiner KHANH TRAN